Tolerance response of tomato plants (Solanum lycopersicum L.) to climate change: biochemical aspects of salinity- and/or heat-induced stress

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Abstract

In the face of ongoing and projected climate change, including longer and more severe heat waves, longer periods of water shortage and the growing problem of soil salinity, the understanding of plants´ response to the combination of two abiotic stress factors that commonly occur simultaneously - salinity and heat - is a matter of special interest. Thus, in this study, the effect of the co-exposure of tomato plants (*Solanum lycopersicum* L. var. *cerasiforme*) to salt (100 mM NaCl) and heat (42 ºC; 4 h/day) was evaluated. After 28 days of growth, 21 of which under the salt irrigation and/or heat exposure treatment, plants were collected and used for biometric and biochemical measurements. The individual exposure of tomato plants to heat or salt led to a significant reduction of both shoot and root length and dry weight, which was more pronounced in the combined treatment. Moreover, the co-exposure treatment negatively affected chlorophylls and carotenoids content, again, impacting much more on these parameters than the individual stresses. Lipid peroxidation levels in shoots also decreased, similarly to individual treatments. However, in roots, only the heat stress showed this effect. Hydrogen peroxide levels were reduced in shoots for every treatment and, oppositely, increased in roots for both heat and combined treatments. In what concerns antioxidant metabolites, glutathione levels were equally reduced in plants exposed to salt and the combined treatment. Contrarily, these two treatments led to an exorbitant increase in proline - a powerful osmolyte - in the whole plant, although this effect was more pronounced when the plants were exposed only to salt stress. Overall, the results of the present study suggest that tomato plants adopt different strategies for each stressor, however, further studies are underway to better understand the biochemical basis underlying tomato´s response to combined heat and salinity stress.